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Length-weight relationships and condition factors of fifteen fish species from Pabean Bay, West Java, Indonesia

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Abstract. Length-weight relationships (LWR) and condition factors (CF) were calculated for thirteen fish species using 621 specimens from Pabean Bay, West Java, Indonesia. This study is the first reference on length-parameters and condition factors for fifteen species, namely: *Ambassis vaschelli*, *Arius* sp., *Asterhombus intermedius*, *Butis amboinensis*, *Eleutheronema tetradactylum*, *Gerres abbreviatus*, *Johnius coitor*, *Glosogobius sirkumspelitus*, *Karalla dussumieri*, *Lutjanus ruselli*, *Pomadasys kaakan*, *Pseudorhombus arsius*, *Sardinella gibbosa*, *Strongylura strongylura*, and *Terapon jarbua*. Fish caught montly from January to December 2015, using gillnet and set net. The results of LWR and CF from fifteen fish species indicated that the growth pattern was: 3 species were allometric positive ($b>3$), 1 species was isometric ($b=3$), and 11 species were allometric negative ($b<3$).

1. Introduction

Length-weight relationship (LWR) is one of the important factors in the study of fish biology and stock estimation [1]. With this relationship, we can estimate the weight of a fish from its length. According to [2], [3] the uses of LWR are stock assessment models, estimation of the biomass of a species from length frequency distributions, estimate the condition of fish and for life story and morphological comparison of life histories of a certain population from different region. There have been many studies that have been reported regarding the LWR of several species of fish from in an area or waters [4], [5], [6] dan [7].

According to [8], [9] and [10] the value of the fish condition factor is an indicated of fish fatness in their habitat, and also reflect to the conditions of gonadal development. In addition, things that affect the psychological condition of fish consist of two factors, namely: intrinsic and extrinsic. Intrinsic factors include gonadal development and store of fat; whereas Intrinsic factors include availability of food and quality of the aquatic environment. On the other hand, condition factor value can explain when the fish spawn, and can detect the presence of various fish spawning areas [11] and [12]. Other researchers [13] stated that the condition factor decreased when the fish are in polluted areas; but according to [14] the maturity level of broodfish (*Siganus rivulatus*) gonadal is increased.



Pabean Bay is located at the springhead of the Cimanuk River, therefore Pabean Bay is an estuary area, and still covered by mangrove vegetation. As an estuary area which is also known as a nursery area for fish and shrimp larvae, this area is rich in fish biodiversity. That is why, in Pabean Bay is a habitat for various fish species, and fifteen the fish species found in these waters is: *Ambassis vaschelli*, *Arius* sp., *Asterhombus intermedius*, *Butis amboinensis*, *Eleuthronema tetradactylum*, *Gerres abbreviatus*, *Johnius coitor*, *Glosogobius sirkumspelitus*, *Karalla dussumieri*, *Lutjanus ruselli*, *Pomadasys kaakan*, *Pseudorhombus arsius*, *Sardinella gibbosa*, *Strongylura strongylura*, and *Terapon jarbua*. The purpose of this study is to determine the length-weight relationship and evaluate the condition factor of fifteen fish species in the waters of Pabean Bay, West Java, Indonesia.

2. Material and methods

Fish samples were collected monthly from January to December 2015 with two types of fishing gear. There are three zones as a sampling location in Pabean Bay, West Java. Zone one is located in the bay, zone two is located in front of the river mouth and zone three is located in the outer region of the bay (figure 1).

The two types of fishing gear are gillnet and something trap as a guiding barrier, usually fishermen in Pabean Bay called “sero”. The mesh size of gillnet between 1.5 to 1.75 inches, 400 m long and 1.5 m high. Whereas, the mesh size of sero is 1 mm and a height of 1 m. Sero made of bamboo, and placed in the afternoon and lifted in next day at the morning. The utility of sero is blocking and directing the fish to fishing bag.

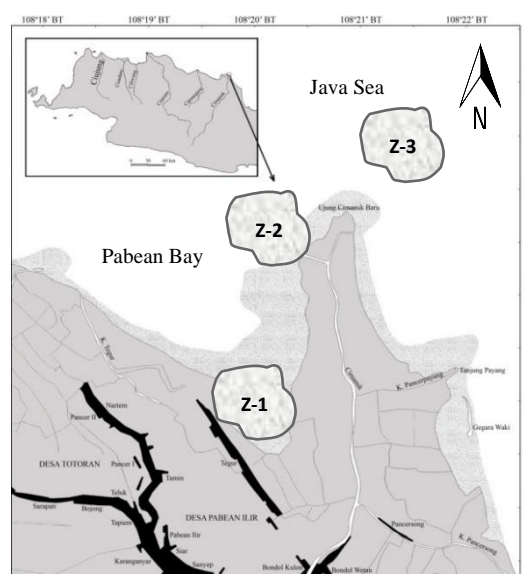


Figure 1. Maps of locations, Pabean Bay, West Java, Indonesia.
Z-1, Z-2, Z-3: sampling station

After the sampling fish are collected, they are then immersed in a formalin solution 5-10%, and brought to the laboratory for analysis. Total length of each fish was measured to the nearest millimetre and weighed to the nearest gram. These data were used to establish the LWR of fish and fish condition factors. The LWR is calculated using the formula:

The length-weight relationship is calculated using the formula:

$$W = aL^b$$

W = fish weight (gram), and L = fish length (mm)

The relative condition factor (Kn) is calculated using the following equation:

$$K_n = \frac{W}{aL^b} \quad [1]$$

W = observed fish weight (gram), and L = fish length (mm)

3. Result and discussion

Totals of 770 specimens belonging to fifteen fish species were used by calculation of LWR (Table 1).

Table 1. Descriptive statistics and estimated parameters of length-weight relationships ($W = a L^b$ in g and cm) for fifteen fish species in Pabean Bay, West Java

No	Species	n	Length (cm)		Parameter		r	Kn
			Min	Max	a	b		
1	<i>Ambassis vaschelli</i>	130	3.6	9.2	0.065	1.8902	0.745	1.0911
2	<i>Arius</i> sp.	122	4.1	27.8	0.0159	2.7652	0.934	1.0938
3	<i>Asterhombus intermedius</i>	70	2.9	16.4	0.0219	2.6645	0.981	1.022
4	<i>Butis amboinensis</i>	26	3.4	10.7	0.0203	2.705	0.936	1.0232
5	<i>Eleuthronema tetradactylum</i>	39	4.6	17.4	0.0227	2.4087	0.93	1.064
6	<i>Gerres abbreviatus</i>	23	5.1	11.8	0.008	3.3158	0.943	1.0679
7	<i>Johnius coitor</i>	35	5.1	8.2	0.4037	1.0933	0.398	2.4062
8	<i>Glosogobius sirkumspeltus</i>	29	8.1	20.6	0.0247	2.4919	0.85	1.074
9	<i>Leiognathus dussumieri</i>	27	3.9	10.6	0.0079	3.2375	0.982	1.0116
10	<i>Lutjanus ruselli</i>	51	5.2	17.4	0.0081	3.2445	0.987	1.0241
11	<i>Pomadasys kaakan</i>	83	3.6	15.2	0.0133	3.0836	0.984	1.033
12	<i>Pseudorhombus arsius</i>	30	4.1	13.6	0.0402	2.2821	1.036	1.036
13	<i>Sardinella gibbosa</i>	32	3.5	32.9	0.024	2.5557	0.98	1.0076
14	<i>Strongylura strongylura</i>	25	8.4	44.6	0.0018	2.8939	0.976	1.0307
15	<i>Terapon jarbua</i>	46	4.7	22.3	0.0277	2.7693	0.982	1.0091

Three different growth types were exhibited in this study, one species is *Pomadasys kaakan* or Javelin grunter showed isometric growth (Figure 2), which means this species grow in length and biomass in equal shares. Research result from [15] in Persian Gulf, reported that the same growth pattern of *Pomadasys kaakan* showed isometric growth ($b=3$, $P > 0.05$).

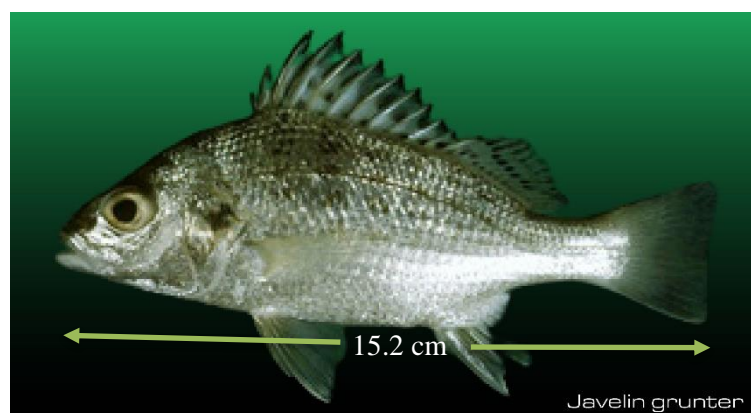


Figure 2. Javelin Grunter, *Pomadasys kaakan* [16], species showed isometric growth

The other three species are: *Gerres abbreviatus*, *Karalla dussumieri* or Dussumier's ponyfish, and *Lutjanus ruselli* or Russell's snapper showed allometric growth (Figure 3), which means these

species grow proportionately more in weight than in length. Several other researchers reported that *Gerres filamentosus* (Cuvier, 1829) from Kodungallur, Azhikode Estuary, Kerala, India [17] showed allometric negativ growth.

Meanwhile, other researchers reported that *Leiognathus brevirostris* or Shortnose ponyfish from Palk Bay at Mandapam region [18] showed isometric growth. Then [19] state that the parameter b of Dory snapper, *Lutjanus fulvivflamma* is 3.987, were caught on the Kenya Coast, Africa.

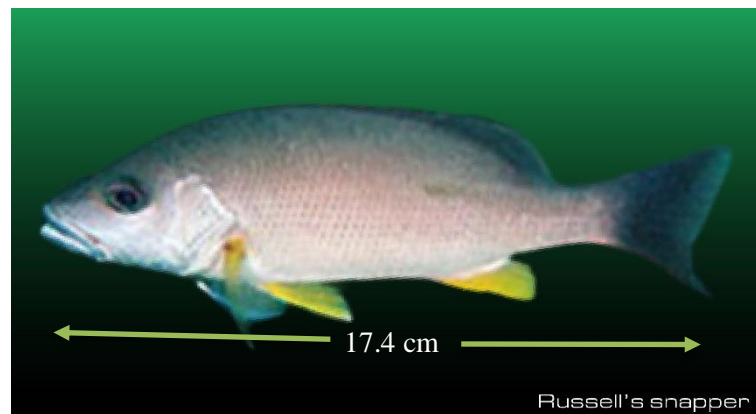


Figure 3. Russell's snapper, *Lutjanus russelli* [16], species showed allometric positif growth

Model growth of eleven species in this present study showed allometric negativ growth, namely: *Ambassis vascelli* or Vachelli's glass perchlet, *Arius oetik*, *Asterhombus intermedius* or Intermediate flounder, *Butis amboinensis* or Olive flathead-gudgeon (Figure 4), *Eleuthronema tetradactylum* or Fourfinger threadfin, *Johnius coitor* or Coitor croaker, *Glosogobius sirkumspelitus* or Circumspect goby, *Pseudorhombus arsius* or Largetooth flounder (Figure 5), *Sardinella gibbose* or Goldstripe sardinella, *Strongylura strongylura* or Spottail needlefish, and *Terapon jarbua* or Jarbua terapon (Figure 6) which means these species grow more in length than in weight.

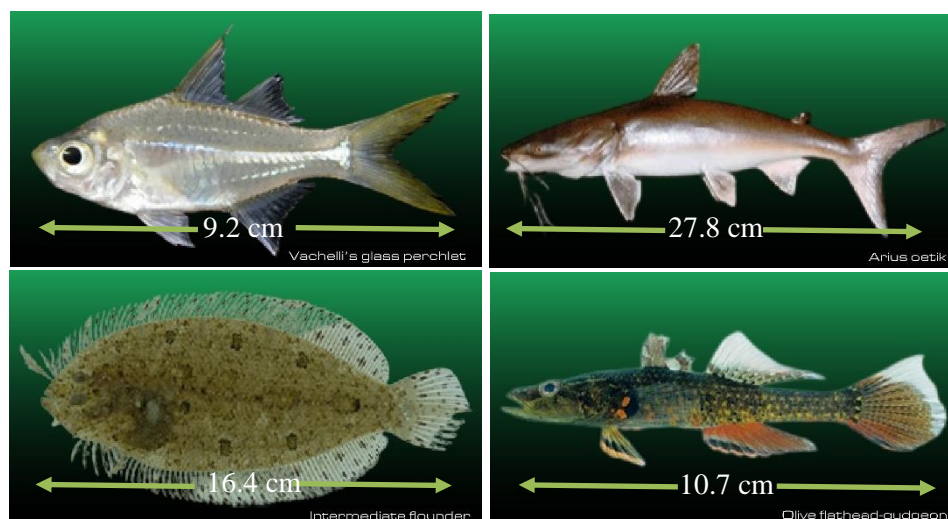


Figure 4. Four species showed allometric negative growth, namely: Vachelli's glass perchlet, *Arius oetik*, Intermediate flounder and Olive flathead-gudgeon [16]

In this present study, *Ambassis vascelli* or Vachelli's glass perchlet showed allometric negative growth, in line with model growth of *Ambassis ambassis* (Lacepède, 1802) which caught from Mandovi-

Zuari estuarine system along the west coast of India [20]. Another researcher [21] reported that *Arius oetiki* at the same location, Pabean Bay showed “b” value is 2.792.

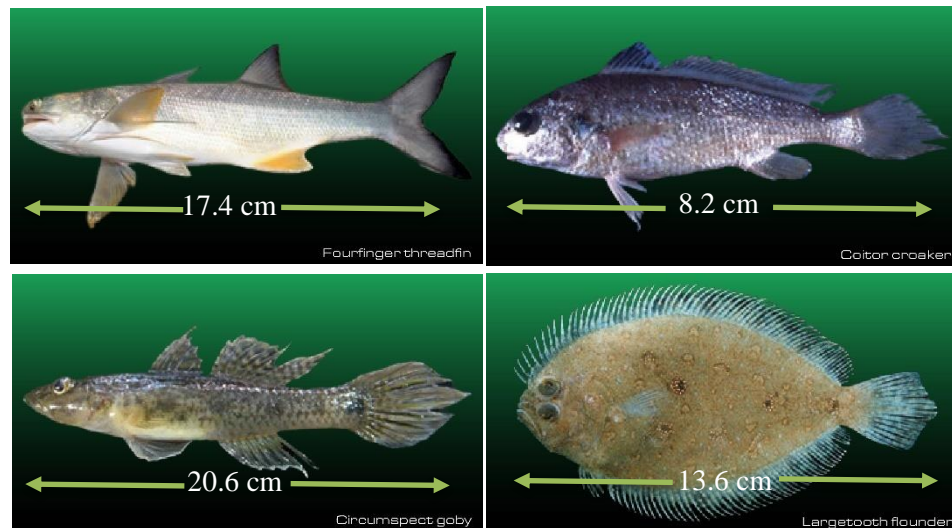


Figure 5. Four species showed allometric negative growth, namely: Fourfinger threadfin, Coitor croaker, Circumspect goby and Largetooth flounder [16]

Growth pattern of Kuro, *Eleuthronema tetradactylum* at estuarine of Kumber River in Merauke District was allometric positive [22], as well growth pattern of *Johnius coitor* was reported with a value of “b” is 3.246 [23], also growth pattern of *Pseudorhombus arsius* reported with a value of “b” is 3.535 [24]; meanwhile in this present study growth pattern of *Eleuthronema tetradactylum*, *Johnius coitor* and *Pseudorhombus arsius* were allometric negative or $b < 3$. This condition can be happen if the water quality in (a) the Kumber river estuary, Papua, Indonesia; (b) the River Ganga, India; (c) Korangi-Phitti Creek area, Indus delta, northern Arabian Sea were more supporting to fish growth, than in Pabean Bay, west Java, Indonesia. Even though the three locations are estuaries or we know as a nursery ground area, which have an abundance of natural food; but as is known, the energy used to eat is prioritized to maintain metabolic balance. Locations with poorer water quality put a certain pressure on metabolic processes. That is why at a location like this, the energy to grow is reduced which is indirectly indicated by the parameter value “b” < 3 . So that it can be estimated that the growth model shows a negative allometric growth.

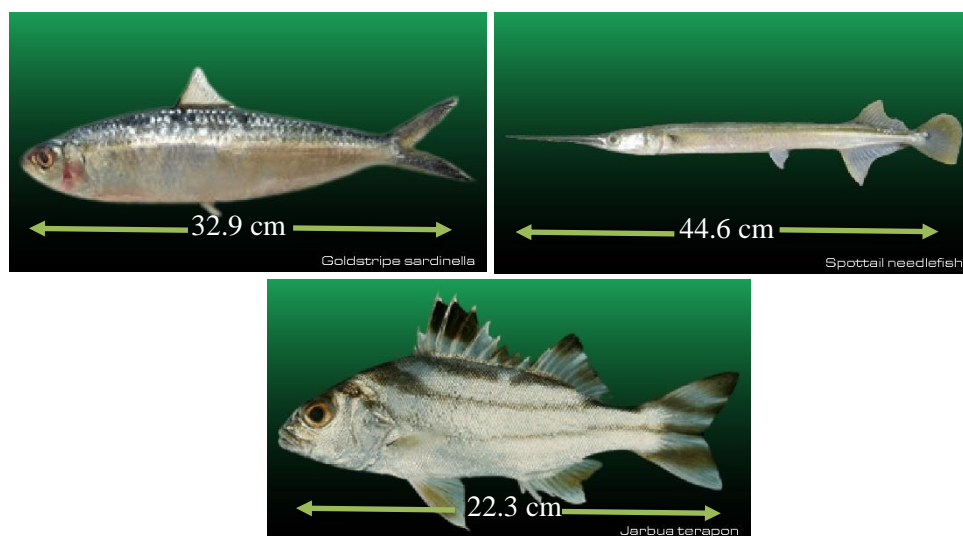


Figure 6. Three species showed allometric negative growth, namely: Goldstripe sardinella, Spottail needlefish, and Jarbua terapon [16]

In Figure 6, three species in this present study showed allometric negative growth, but other researchers who conducted studies in different waters reported different growth models. [24] reported growth pattern for *Sardinella gibbosa* from the waters around Palawan Island, Philippines, was isometric growth; [25] reported growth pattern for *Strongylura leiura* from Kerala waters, south-west coast of India was allometric positive growth, as well as [26] reported growth for *Terapon jarbua* from Bengal Bay Puducherry, East coast of India was allometric positive growth.

The results of LWR and CF from fifteen fish species namely: *Ambassis vaschelli*, *Arius* sp., *Asterhombus intermedius*, *Butis amboinensis*, *Eleutheronema tetradactylum*, *Gerres abbreviatus*, *Johnius coitor*, *Glossogobius sirkumspelitus*, *Karalla dussumieri*, *Lutjanus ruselli*, *Pomadasys kaakan*, *Pseudorhombus arsius*, *Sardinella gibbosa*, *Strongylura strongylura*, and *Terapon jarbua* indicated that the growth pattern was: 3 species were allometric positive ($b > 3$), 1 species was isometric ($b = 3$), and 11 species were allometric negative ($b < 3$).

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